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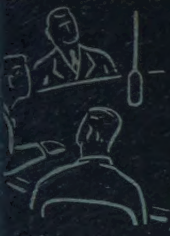

Round Table

Can There Be a Science of Human Behavior?

An NBC Radio Discussion by DAVID EASTON
JAMES G. MILLER *and* ANATOL RAPOPORT

Including

A SCIENCE OF HUMAN BEHAVIOR

By JAMES G. MILLER

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THE UNIVERSITY OF CHICAGO ROUND TABLE
GEORGE E. PROBST, *Director*
CATHERINE D. JOHNSON, *Editor*

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Can There Be a Science of Human Behavior?

*

Dr. Miller: Can science save us? That question has been raised for years, and some have thought that it can. But, with the passage of time and the development of the modern techniques of destruction, it seems as if science is contributing more to the loss of our civilization rather than to saving us. If this trend is to be reversed, there must be a drastic acceleration of the sciences of man.

For some time a group of faculty members of the University of Chicago have been working together to see if it is possible to develop a general theory of human behavior which can be tested by careful scientific methods employed in several academic fields. It is our hope to be able to carry out such studies in an institute of behavioral sciences. Two fellow-members of that group are here with me today, and we want to discuss some of the difficult issues which have confronted us. The first of these is whether such an endeavor makes any sense at all and whether it is even possible to apply science to human beings. In order to approach this, I am going to ask you, Rapoport, from your background in biology and mathematics, what is the method of science?

Mr. Rapoport: I think that the most straightforward way of defining science is simply to list some universally recognized sciences—for example, astronomy, physics, and chemistry. To see what science means is to understand what these established sciences have in common. They have in common a method which makes it possible to describe just what consistently happens under specified conditions. More than that, a physicist, an astronomer, and a chemist can predict what is going to happen under sufficiently specified conditions. Sometimes this ability to predict what is going to happen enables us to control what is happening; and in this control should be the most powerful impact of science of human affairs.

Dr. Miller: Tell us about this method.

Mr. Rapoport: To sum up the chief characteristics of science I would

say, first, that it is knowledge organized in such a way as to enable us to describe certain regularities and consistencies in the course of events; often to predict events on the basis of these regularities; and sometimes to control events on the basis of predictions. At least this is how science appears to me, I suppose because my training has been largely in the natural sciences.

DR. MILLER: Easton, your background is a good deal different. You have been working in the field of politics and carrying out research in that area. This is one of the social sciences. How do the social sciences differ in your conception from the natural sciences?

MR. EASTON: As you say, my background is somewhat different from that of either you, Miller, or that of Rapoport's. Rapoport's background is primarily in the physical sciences. Yours, Miller, is in biology and psychology. All my training and experience has been in the field of social science. There is one important difference, it seems to me, between the sciences, at least of physics and biology, and the science of human behavior.

DR. MILLER: What is that?

MR. EASTON: The difference lies in the subject matters with which they deal. Of all the sciences, social science alone is concerned with the way human beings behave in relationship to one another. This difference should not conceal from us the similarity of the social sciences to the other sciences. They all deal with their different subject matters in basically the same way. By this, I mean that the rules governing a dependable and rigorous investigation are the same. Obviously, the techniques of the physicist and the biologist may differ from those of the social scientist, who is devoted to the study of human interaction.

MR. RAPOPORT: Very largely, yes.

MR. EASTON: The social scientist, as you well know, does not use a microscope or an atom-smasher; on the other hand, the physicist or biologist does not use a questionnaire or personal interview.

MR. RAPOPORT: One cannot talk to an atom.

MR. EASTON: One cannot very well do that, but the logic, I would point out, underlying the research of all these scientists is identical.

DR. MILLER: Tell us what that is, then, if you can.

MR. EASTON: The logic underlying all these methods of research con-

sists of a certain mode of classification of your data; a certain way of observing your data; a certain way of interpreting it. It would take us into too great detail to explain it here.

DR. MILLER: How does that differ from the thinking which we carry on every day?

MR. EASTON: It leaves us an important question, it is true. Through its common method the sciences seek reliable knowledge, but through our everyday approach to data we too seek reliable knowledge. Therefore, one could easily ask: Does science not have exactly the same objective as common sense? Do we not all seek reliable knowledge? If this is the case, how then does science differ from good old common horse sense? Is science simply an elaboration of common sense, or is it something absolutely different?

MR. RAPOPORT: I would say that it is very different.

DR. MILLER: I would agree; and it is obvious to us that, while it comes from the same source, science has been developed and refined over a period of centuries. The scientific method has been made explicit, and we have a good deal clearer knowledge as to how precise quantitative facts can be learned than we did back in the days when common sense was all that man had available to his reason.

MR. RAPOPORT: Nevertheless, man has used common sense for quite a while and sometimes with great success, would you not say?

DR. MILLER: Yes, sir. I would say, for example, that the old wives' tales which we all know and which come out in our conversation every day are excellent illustrations of this common sense on which we all rely to solve the basic problems of life.

MR. EASTON: What do you mean by that?

DR. MILLER: You know, these statements: "Look before you leap" and things like that. The only trouble with them is that there is always the opposite, and we can quote the other side almost as easily in any given situation. For example, there is "Look before you leap," on the one hand, and "He who hesitates is lost," on the other. The trouble with these things is that we tend to use whichever argument we want to support our particular side of the issue. So, for example, we have "Two heads are better than one," but, on the other side, "Too many cooks spoil the broth." Or "A stitch in time saves nine" but "Don't cross your bridges until you come to them."

MR. RAPOPORT: How about this one? "Birds of a feather flock together"; on the other hand, "Don't judge by appearances."

MR. EASTON: You gentlemen have given these contrasts, but let me, for the moment, be the devil's advocate. Let us take an instance of the use of common sense. Let us take the case of a young lover sending her fiancé a letter in which she is preparing the ground for breaking off her engagement. Give this letter to a scientist. He sees little but a love letter. The recipient lover, on the other hand, reads between the lines. His informed common sense tells him that a storm is brewing. Or let us put this matter on a political level. A good precinct captain can predict within a very few per cent the vote which will be cast in his precinct at least for a coming election.

DR. MILLER: As a matter of fact, I heard that one of our political leaders here in Chicago said that he would rather have a precinct leader who can predict on the basis of common sense within 1 or 2 per cent of how his precinct is going to go than to have one who will carry the precinct.

MR. EASTON: On the basis of what you have just said, science, you will agree, has found this most difficult to do. How would you say that science is here superior to common sense?

MR. RAPOPORT: One must also look at the other side of this story. Common sense can often lead us astray. This is so because common-sense judgments are based largely on immediate experience; and, valuable as immediate experience may be, you cannot deny that immediate experience is usually limited. Examples of how common sense gave us wrong steers are so numerous that I am almost tempted to define science as an antidote to common sense.

DR. MILLER: That is a strange way. Give us some examples to let us see what you mean by that.

MR. RAPOPORT: The notion that the earth was flat was dictated by common sense. So was the notion that the earth is motionless. Anyone can see that for himself. He just looks out of the window. He will see that the sun keeps going around the earth and certainly not vice versa. Less than a hundred years ago, physicians argued, again invoking common sense, that such tiny creatures as bacteria could not possibly kill such a powerful, large creature as a man.

MR. EASTON: But were these physicians not also scientists in their day?

MR. RAPOPORT: Yes, they were, of course. But science changes, you see. Now that we have scientific theories dealing with interstellar space and with interior of atoms, the separation of science from common sense has become complete. There simply is no common-sense notion by which one can explain the curvature of time-space; or, when the scientist insists that light is a wave phenomenon and also that light consists of minute particles, this seems to go contrary to the common-sense notion that light cannot be both waves and particles. I daresay that, when and if the science of human behavior is developed to an extent comparable to that of natural science, many of our present common-sense notions about human behavior will have to fall by the wayside.

DR. MILLER: Then you mean a scientific model of man, when we finally get one, may not look anything like a man?

MR. RAPOPORT: I said if and when the social sciences are developed to an extent comparable to that of the physical sciences.

All too often so-called common-sense explanations of human behavior are largely rationalizations of emotionally biased prejudices, and these are hard to overcome.

DR. MILLER: I come from a field—that is, medicine—where common sense has frequently been stated to be the primary and most important accomplishment of the clinician; and we have many examples in the history of medicine where clinicians, physicians, basing their diagnostic skill on intuition and common sense, have made what turned out later to be very serious errors even though they were then convinced that this was the best method of making a diagnosis. I think, for example, of the work which was done by the men who prided themselves in the last century particularly on the ability to use the stethoscope on the lungs to diagnose tuberculosis of the lungs.

MR. RAPOPORT: What was the batting average?

DR. MILLER: The batting average did not turn out to be good whenever they had X-rays to come along and check on them. You could find that the men who before had the greatest prestige throughout the world for ability always to pick up tuberculosis and were convinced that they never could make a mistake with the stethoscope were missing cavities in the lungs caused by the tuberculosis germ, cavities as big as three or four centimeters in diameter on occasion.

MR. EASTON: But I am impressed by the kind of examples which both

you and Rapoport use. You are identifying common sense with the insight and the conclusions which earlier scientists had used, and it seems to me that there you do not have an illustration really of common sense but an illustration of how earlier scientists simply did not have the knowledge which we have by the use of our modern techniques. Therefore, I do not think that we have really struck at the heart of the difference between science and common sense.

DR. MILLER: What is the heart?

MR. RAPOPORT: I would say that the science of today may be the common sense of tomorrow; and perhaps the common sense of today is the superstition of tomorrow.

MR. EASTON: That may be true, but you are still emphasizing the truth or the falsity of the propositions which the person who uses common sense or the person who uses science develops. It seems to me that these propositions that you attribute to common sense were the propositions which were advanced by earlier social scientists at a lower level of technique. The difference between common sense and science technique seems to me to lie in the rules governing the form of inquiry. Common sense uses only ordinary unconscious procedures; science uses technical rules. In earlier days the technical rules may not have been of that quality which could have given us the kind of knowledge which we have today, but over the centuries scientists have developed and improved their rules so that through a process of trial and error they have found that if you want to observe and report accurately with regard to what happens in the world, and if you want to be able to analyze correctly what you see, you must follow certain given rules of procedures. To get the best results, in fact, it seems to me that you must be very technical in the way that you make your observations and draw conclusions. For example, it may seem quite simple to observe accurately what people do. In practice, however, you seldom find two untrained people who will describe the same event in the same way. It is common knowledge and almost ludicrous how witnesses to a motor accident seldom agree even on the essential facts. And what happened in the past was that scientists had not developed these rules to the point of sophistication that we have today; and therefore their conclusions are less adequate than ours are today. This still leaves us with an essential point unanswered.

DR. MILLER: What is that essential point?

MR. EASTON: I feel that this is the essential issue of our discussion here: Let us assume that we know that science consists of its procedures and rules. But are these procedures applicable to the study of human behavior? Many students of human society say most vigorously that they are not.

DR. MILLER: This the question, then: Can you really apply science to human behavior? I do not think that we are going to be able to settle that by dealing in generalities. We have to get to specific cases, specific examples of how we have been able to apply this method or make efforts to apply it to human beings.

Rapoport, I know that you have been working for a long time on such examples. I wonder if you could tell us a little bit about what you have been doing.

MR. RAPOPORT: Some examples occur to me. Easton, you said that the characteristic of science, as differentiated from common sense, is that science uses sophisticated and technical procedures. Let me briefly summarize this point of view so that I can get into these examples. It uses systematic observation often in specifically controlled situations, and that is what is called controlled experiments. The situations are specifically contrived in order to permit the operation of these technical methods.

Secondly, powerful methods of reasoning, far transcending the reasoning of common sense, are used in scientific procedures. This kind of reasoning requires a special kind of language. This language is called mathematics.

DR. MILLER: How have you been able to apply controlled methods in mathematics to a specific problem?

MR. RAPOPORT: Here is a specific problem. I have in mind experiments which were conducted in recent years at M.I.T. These experiments had to do with small groups of people who were given a task which they could not perform or a problem which they could not solve unless they pooled their common knowledge together. In order to do that, they had to communicate with each other. The point of the experiment was that a communication net was prescribed. Here is what I mean by "communication net." It is a system of rules prescribing who may talk to whom—just as we had in the army—channels, you know. One can only talk to his immediate superior, or his immediate inferior,

and not otherwise. For example, if the three of us here were engaged in the solution of a problem, we could set up a communication net in more than one way. For example, both Easton and I could talk only to you, Miller, and then you could talk back to us. In this way we could eventually communicate everything we know to each other through these channels. Or else we could set up another system. For example, I could talk to you; you could talk to Easton; Easton could talk to me, but not otherwise.

DR. MILLER: The first would be sort of a star arrangement . . .

MR. RAPOPORT: That is right.

DR. MILLER: . . . and the second would be more like a loop.

MR. RAPOPORT: Or a closed chain, I would say. Now, under these controlled conditions of communication, these groups performed these tasks; and what the psychologists and others at M.I.T. were concerned with. . . .

DR. MILLER: This is Bavelas's work, is it not?

MR. RAPOPORT: Alex Bavelas; that is right. What they were concerned with was to learn just how rapidly and how efficiently the group learns to solve the particular kind of problem for a particular communication net. It turned out that the communication net was more important in this connection than the individuals involved in it.

DR. MILLER: How do you mean?

MR. RAPOPORT: Let us take three individuals of very low I.Q. and three individuals of very high I.Q. The difference of time in which it will take them to learn a specific task may be less than the individuals of the same I.Q. operating in a different communication net.

MR. EASTON: What you are talking about sounds very familiar to me as a political scientist, because you are dealing with a problem of organization.

MR. RAPOPORT: Yes.

MR. EASTON: And I wonder whether the conclusions which were arrived at on that experiment dealing with a small number of human beings could be applied to such a large institution as a political system, which involves the relationship between governmental organization and the people as a whole. Could you say that your conclusions there

could give us any insight as to whether we ought to have a federal form of organization or a highly centralized form of organization if we want to achieve our objectives in the most efficient way?

DR. MILLER: You mean, a highly centralized form such as perhaps we had during the New Deal versus a much more decentralized states' rights organization; or, perhaps, the sort of government which we had before the United States was set up and as it was under the Continental Congress.

MR. EASTON: Something of that order, although during the New Deal, when we compare the form of organization of the United States with that of Britain, we still had a federal system which differed substantially from the form of organization in Britain.

MR. RAPOPORT: I would say that it would be quite foolhardy to try to apply the conclusions from these very modestly conceived small-scale experiments to such large-scale phenomena as political states. The value of these experiments is not so much that they give us answers as to how human society ought or ought not to be organized. The value is that it sets us thinking along lines which in other sciences at least have proved to be consistently fruitful.

I have in mind, for example, the early experiments of Faraday on electricity. These experiments did not enable us to build powerhouses and to apply electricity in all the various ways that it has now been applied. There is a long intermediate period in which the results of these experiments are broadened and ramified until the technology built on this knowledge can become a reality. But the importance of those early experiments with electricity were just these: That they were controlled experiments, and therefore they enabled us to achieve this knowledge in a systematic way.

DR. MILLER: This work about which you have been talking, done at M.I.T., we know, was quantitative work. It was possible for them to measure, quite precisely, the way communications traveled in the star-shaped group and in the group where they had a loop or a closed chain. This is one of the methods of science about which you talked, the mathematical method. Then there is also the possibility of using the small group as a model for the way the large society or the large government would operate. And we recognize all the dangers of that. Some of them have been brought up already by Easton. How-

ever, in general we are dealing here with a scientific method which can be applied to people and which is equally precise in possibility at least to that which has been used in the natural sciences.

MR. EASTON: I think that Rapoport's illustration indicates how science can be used at least in relationship to small groups, but I think in political science itself, or the area of politics, we have illustrations of the way in which we can use the same method and apply it to larger groups and derive conclusions which are immediately applicable to the whole of the social system.

MR. RAPOPORT: There have also been experiments dealing with large groups. I have in mind experiments performed on the West Coast dealing with the spread of rumors in populations. Again, as I said, these experiments were modestly conceived and controlled. The rumors were planted; the situations were artificial. Nevertheless, they yielded a great deal of useful information.

MR. EASTON: But even there you are still talking about a situation in which the investigators can manipulate the people whom he is investigating. But it is important, I think, to realize that the scientist can also go to a situation in which he does not manipulate to this extent . . .

MR. RAPOPORT: Like the astronomer.

MR. EASTON: . . . and can investigate it very accurately. Let us take the case of voting. What are the facts which influence a voter to make up his mind to vote for one person as against another? Here one can take an actual presidential election, as a group of social scientists did in 1940 and 1944. Now, if you consider voting, it may appear that each person is perfectly free to make up his mind in his own way. We are taught that that is a matter for the individual's private conscience. Contrast this, however, with the knowledge which we now have through these inquiries which were made and which are still going on that our political preferences have actually been shaped for us by our early experience in our family, in our social group, in the neighborhood in which we happen to live. This study about which I talked was made by Paul F. Lazarsfeld, at Columbia University, and Bernard Berelson, who at that time was a professor at the University of Chicago. They demonstrated, through the investigation of an actual situation, that how a person votes depends in good part on

his religion, on his social and economic position in the community, and on his family's voting tradition. For example, this study confirmed what had long been suspected by party leaders and bosses, without however having rigorous proof. These studies demonstrated that Catholics, for example, have a greater tendency to vote Democratic than Protestants; that rich people have a greater tendency to vote Republican than poor people; or that people who live in an urban center have a tendency to vote Democratic rather than people who vote in a rural center, who vote Republican.

DR. MILLER: In other words, you might say that we do not really have a secret ballot; that the Australian ballot, as we practice it, is not secret, but that, when we go in there to that ballot box, we have our family, our ancestors, and our neighbors all coming along with us and jogging our elbow and telling us where to put the *X*. Is that it?

MR. EASTON: In a sense, yes; and in a sense, no; because this research does not enable us at least to predict how an individual will behave, but it does enable us to predict how large groups of people will vote.

MR. RAPOPORT: This is the important thing, you know. We do not really have to know how each individual will vote in order to know how the election will come out. All we need to know is percentages; and this is precisely where the scientific method comes in. It can abstract the behavior of the individual and nevertheless conclude what the probable behavior of the mass will be.

DR. MILLER: I want to give an example out of the area of biology, with which I have been particularly concerned, because I believe that nature is continuous—that we are all in the same world, whether we be animals or human beings; that the electrons which go to make up the inanimate world follow some of the same laws which are found in the world of animals and of human beings. I think that sometimes it is profitable to look at some of the researches which have been carried out in the biological areas to see how they are similar to the investigations which we can make in the social sciences. Let us take, for example, a far-fetched illustration—perhaps in some ways it looks almost like a poetical metaphor. From the field of botany, there is a slime mold, so called, a little micro-organism like an amoeba.

Biologists have discovered that, under ordinary conditions of adequate water and food, a colony of this plant can be made up of quite independent individuals, operating quite independently, even reproducing independently. But under more stressful conditions, when the environment is less favorable, these individuals flow together to form what is essentially a single multicellular organism with specialization of function and distribution of labor, just the way that we have it in the modern factory today. Some become central cells; others peripheral cells, which always flow toward the center, wherever it may be. Some cells reproduce, and others cannot.

This seems to me a remarkable model of how human beings, under stress, can group together in societies against the common enemy. For example, the way Britain did during the fire raids on London.

MR. EASTON: I do not know whether your example is really well chosen, at least as an illustration of how we can apply scientific method to human behavior, because you have taken as an illustration the micro-organism. One could also consider a micro-organism which bumps up against some material object, and it reacts negatively and moves away. But I am not certain that we can say the micro-organism remembers this and will therefore use this information in his future behavior. Furthermore, if two micro-organisms come into conflict over a given object, there does not seem to be very much interaction between the micro-organisms.

DR. MILLER: I recognize that there are a lot of problems in analogies like this which we could discuss at length, but let me give you another example from a different area. One of the problems with which we are concerned in human beings is where they get their values—how they decide what is worth doing and what is not. We found that with animals it is possible to study their values. Let us take rats. We can study to discover when they are hungry and also thirsty whether they turn toward the water or toward food. With human beings we learn their values by seeing what they run back into a burning house to retrieve—whether it is a family portrait or the family Bible. Perhaps in societies it is possible also to find out similar things.

For example, we have discovered that in India, during the starvation periods in the 1890's, the Indians first would sell their daughters and later would sell themselves into slavery in order to get food. But they would never kill their cattle. On the other hand, we in

America, first of all, because we do not hold cattle to be sacred, would kill our cattle first, and only very much later would we turn to the selling of individuals into slavery.

MR. EASTON: Let us assume everything we say about the applicability of science to social behavior is quite correct. There are still some limitations, I think, which we ought to point out as to what science can do. It cannot solve all our problems. For example, the problem of the basic conflict which exists in our interests. This I think is a problem which science would have difficulty in solving.

DR. MILLER: Certainly it is obvious from our discussion today that we of the faculty group planning the Institute of Behavioral Sciences do not always agree. In fact, during our long months of planning discussions, we have adopted Pogo the Possum's cry of academic freedom which has served to unite us in brotherly conflict: "I disagree with every word you say and will fight to your death for my right to deny it." Nevertheless, we do share in general the hope that the methods of the natural sciences can be applied to the study of the conduct of individuals and groups.

Candor forces us to admit that this is only one of the acceptable points of view in the behavioral sciences. Many reputable social scientists would not today accept even the simple, common hope which unites us. And with good reason, for our understanding of how science can be applied to man is still vague and primitive. We are in the position of Balboa, who, having crossed to the Pacific, had a very general notion only of the geography of the new continent and a detailed understanding of a mere few regions.

It will become the responsibility of many geographers of science in the future to sketch precisely the cities, mountains, and lakes, the many facts which can ultimately be organized into a science of man.

A SCIENCE OF HUMAN BEHAVIOR

By JAMES G. MILLER

*

THE PROBLEM

From the beginning, among all the creatures of God, only man has been the rebel. Only man has the one means by which he can change the world into a shape he has chosen. That one God-given instrument is superior reason. Only man has such reason—and only man has the colossal impudence, the burning discontent which lead him to turn the forces of nature to ends of his own selection. Using reason, man has explored, then exploited nature. Always refining his methods of learning, always looking for ways to control new forces, man has developed the whole complex world in which he lives today.

As this has come to pass, reason has led man to science. The scientific method is nothing more than a name for the process of observing what happens, trying to explain why it happens, then testing the explanation by predicting what will happen next. After this process come attempts at control of the forces which have been recognized. With this method, man has changed the world. He almost carelessly reverses flow of rivers. He even attempts to control the vagaries of the weather. Until this point in history, man has been incredibly successful at solving the riddles of the world in which he lives.

But one mystery has defied the restless exploration—the dynamic mind of man. Man's most baffling problem is the riddle of man himself. He has so far been unable to understand the laws of human nature which, when flouted, result in human misery. We see its many forms about us—domestic inharmony, juvenile delinquency, slums, industrial strife, war, disease, mental shipwreck.

The surface has been scratched. Men of science, working in many fields, have been seeking the wellsprings of human conduct, the secret sources of discontent, friction, and strife among men. Their separate sciences have strange, yet familiar names:—The study of man's relations to his fellow-men is sociology. Man's need for government, its creation and use, and the study of friction between nations—these are the problems of political science. The natural history of man, and particularly the study of primitive peoples and their cultures—this is

anthropology. The search for understanding of the hidden and apparent sources of conduct—this is psychology. The fight against mental disease and the study of the related inner workings of the human body are the province of medicine and psychiatry.

And there are other fields where research is done on man—history, economics, education, physiology, mathematical biology. All these sciences can be called by one name—they are the behavioral sciences. They are all studying man, all searching for the answer to the riddle of man. But they are all searching separately, each going a different way. Their skills are specific, but the problems are general.

Why cannot the scientific method solve the basic questions as well as it solves the smaller questions of the individual sciences? Why can not we apply this tool, with which man has won his victories over the physical world, to the problem of uncovering the laws which govern man's conduct, the deepest causes of our strife and our harmony? If the behavioral sciences were brought together and if all their separate skills focused on the problem of discovering these laws, then the use of the scientific method could be broadened. By working together, these scientists would shorten the amount of time required to find answers to basic human problems.

And these answers must be found. If our world is not to be torn apart by the tensions that spring from fear and suffering; if we are not to see the industrial might which we have built crippled or torn down because we do not understand the men who command the machines; if we are not to destroy ourselves with the terrifying weapons we have made, men of our time must learn from science what experience might teach—if we have time.

Our skill in solving human problems, our progress in the behavioral sciences must match the progress of the physical sciences, in order that we may use the forces at our command wisely and for the good of all men. It is to this end that we propose the establishment of the Institute of Behavioral Sciences at the University of Chicago.

WHAT THE INSTITUTE IS DESIGNED TO DO

This proposal involves an effort to condense to a relatively few years scientific advancement which, judging by the history of other sciences, would ordinarily consume a much longer period. To do this, it is essential at this juncture to take stock of and evaluate critically the many discrete findings in these various fields; to integrate them

into some pattern which shows their interrelationship; and, if possible, to develop an all-inclusive theory of behavior. If this theoretical work can be done with any adequacy, significant issues requiring empirical study will become apparent, and a rational program of research can be derived.

The rapidity of recent advances in these areas gives reason to hope that the time is approaching when such work can begin to have application in many fields of human relations, including the area of international relations. Even when the concern is only with pure science, it is highly desirable after the past decades of disorganized and untamed empiricism that an intensive effort be made to review, criticize, and integrate all our knowledge about behavior.

METHODS OF SPEEDING ADVANCES IN THE BEHAVIORAL SCIENCES

1. In constructing theory, we can employ models from the physical sciences. All psychological phenomena are essentially naturalistic—that is, ultimately they can be translated into principles of physics. The physical sciences have progressed through various stages of improving theory—the Pythagorean, Ptolemaic, Copernican, Newtonian, and now Einsteinian eras. Changes in thinking were brought about laboriously in the past, because the physical sciences had no other scientific models to rely on. There were, of course, mathematical models, but these were not grounded in the natural world of events, and scientists could never be sure of their particular application. Behavioral science, like other sciences, can advance by using models. If we draw our models from modern physical theory, it is more likely that they will apply correctly to naturalistic phenomena than if we select models from older, obsolete physical theories, or from areas which have not been tested against the reality of the physical universe. By explicitly undertaking the unprecedented policy of choosing models from modern physics, it is possible that the behavioral sciences can circumvent some of the developmental stages which they might otherwise have to pass through.

2. By having individuals from different disciplines working closely together on both theory and research, communication between disciplines can be greatly improved. There has often been a long lapse between discovery of a principle in one field, its publication, and its recognition and utilization in other fields. Even more important, the various behavioral sciences have developed along lines determined

by tradition, and they are separated from each other by areas of ignorance, often, rather than on any logical basis. If there are general principles running through them all, these are more likely to be discovered by groups from different fields working together, and in close communication, than by individuals working alone.

For another thing, one discipline can contribute to the thinking of another, both in method and in content. For example, anthropologists can aid psychologists in forming a general theory of learning by pointing out the importance of specific cultural variables in the learning process—variables of which psychologists may not know or which they consistently neglect. On the other hand, psychologists can indicate to anthropologists how the use of psychometric-scaling techniques, like the method of paired comparisons, can be used to compare various cultures. This could increase the precision of anthropological research.

Another related possibility is the use throughout all theoretical work of what Bertalanffy has called "general system theory." This is the contention, developing from the unity of science movement, that every system—whether it be a strictly physical system like a dry cell, or an automobile; a biological system like a single nerve cell or organ; a total organism; or a society—has certain formal characteristics which make possible comparison of it with all others. Hence, generalizations about all systems are feasible. One can compare a boat, car, truck, and airplane on certain characteristics, even though they are very different systems. They all have surfaces which protect them in their contacts with the outside world; they all have a steering apparatus, fuel, and power sources. In addition, they all have functional characteristics of speed forward and backward; rates of maximum acceleration and deceleration; a specific mechanical efficiency; and so forth.

Similarly, the cell, organ, organism, and society all have size, a form of protection from the surrounding environment; internal structure; general cohesiveness; input and output of some sort of energy; diffusion and spread of this energy within the system; drives, needs, or an energy source which sets up some sort of potential that results in process, and some degree of equilibrium or steady state maintained with the outside environment.

It may be feasible to analyze systems of any sort in terms of similar classes of dimensions, units, and characteristics. Particularly important is the possibility that the quantitative forms of different functions are

identical. For example, it is likely that the further any system is disturbed from a steady state of equilibrium, the stronger are the forces to return it to balance, and that this is a geometrical function rather than a straight-line function. This is true of the forces which return a discharged nerve cell to a state of responsiveness; it is true of many mechanisms of physiological homeostasis in the body, like the osmotic equilibrium of the blood; it may also be true of the mechanisms of psychological defense, like rationalization or repression. It may be true that these are geometrically more active with an extreme stress or threat to emotional adjustment than with a mild one. Likewise, an extreme threat to a society, like mobilization by an enemy, may make for vastly more strict security regulations and external defenses than a mild threat like a diplomatic protest. The entrance of a small minority group into a culture may meet with little resistance, as in communities where there is only one Negro to every five hundred whites; but if the ratio is 55 per cent Negroes and 45 per cent whites, a vastly greater reaction may result. Psychometric methods may make it possible to compare these similar functions quantitatively.

3. Interlocking research designs will be possible as a result of theoretical work. If two investigations are planned so that they complement each other, a third set of facts can be learned by the interactions between their findings. This effect can mount geometrically, so that it would conceivably be possible for six interlocking researches to accomplish as much as $6 \times 5 \times 4 \times 3 \times 2$ studies could do independently.

4. Formulations can be constructed to deal with physiological, behavioral, and verbal indices of the same events. This procedure has at least two advantages. First, there are known dimensions and techniques for measuring in neurophysiology which makes it somewhat more advanced toward quantified prediction than most of the other behavioral sciences. Second, any scientific method profits by having in-built checks, and this triad of neurophysiological, behavioral, and "subjective" modes of studying phenomena constitutes such a system of checks. A function determined by research using one of the three could potentially be checked in the other two.

Sometimes it is difficult for scientists to get evidence from various routes concerning the same phenomena—we can learn about the chemical constitution of the stars from spectroscopy, or from analyzing meteors, but not yet from rocket trips to them. Similarly, we are

able to study some behavioral principles subjectively and neurophysiologically, but not behaviorally, or, in some cases, subjectively and behaviorally, but not neurophysiologically. If two methods check, however, we can assume that the other method would be comparable.

5. A hypothetical-deductive system for the behavioral sciences can be developed. Although many persons in the past have proposed that the social and psychological sciences be made more scientific by the formulation of a system involving the processes of hypothesis, observation, experimentation, and deduction, no serious attempt has yet been made to do this. It is a well-known fact that no quantitatively valid discoveries were made in the physical sciences until this process of hypothesis and deduction was perfected. In addition, sufficient advantage has not yet been taken of new developments in the fields of semantics and symbolic logic. A precise and systematic methodology devised for the social sciences will advance studies in this area toward a level of precision like that attained in the physical sciences.

CONCLUSION—THE GREAT VISION

Such an approach to the study of man is still in early stages of development. Books on it cannot be more than primers. Perhaps it is not better than the insights of artists or of common sense. But the approach suggested promises more than common sense can—quantitative prediction and a means to distinguish true old wives' tales from false.

Perhaps an over-all theory of behavior is too near the end of the rainbow to be reached; perhaps it is a will-o'-the-wisp. If so, our efforts may still be rewarded by the salvage of microtheories about limited areas.

Perhaps all-out application of deterministic science to man threatens him with the subtle slavery of a *Brave New World* or George Orwell's *1984*. But the more we understand ourselves, certainly the more chance we have of becoming free. Is it not better to act on the basis of clear-cut understanding of the nature of man and society than to live in ignorance? Regardless of whether we can ever control or even predict all the acts of a person, is it not wise to cut our error to the minimum?

Somewhere in all this lurks the hope that the same method which brought control over physical forces, and is plunging us today into the world of tomorrow, can also give us control over ourselves; a hope that adequate understanding of man and society can lead to constructive freedom and avert mass destruction.

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